# History of Michigan Department of Natural Resources and Environment Walleye Culture and Stocking Since Viral Hemorrhagic Septicemia Emerged in the Great Lakes Basin[1]


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## Introduction

Walleye fishing encompasses some of the most diverse and widespread angling opportunities in the State of Michigan. This prized fish species inhabits our Great Lakes waters, inland lakes of all sizes and shapes, and many miles of river throughout the state. When walleye fishing started gaining popularity in the 1970s, the Michigan Department of Natural Resources and Environment (MDNRE) began developing ways to rear large numbers of young walleye for stocking into Michigan lakes and rivers. Walleye production typically consists of raising fry to a total length (TL) of about 1/2 inch and spring fingerlings to a TL somewhere between 1 and 2 inches. To do this we use a combination of on-site hatchery resources and off-site rearing ponds. In the early years when walleye fishing was expanding its reputation and attractiveness among anglers, fish were stocked somewhat indiscriminately throughout the waters of the state. Over time however, fisheries managers learned which stocking efforts were most successful and adjusted their efforts accordingly. Stocking success has typically been determined by the establishment of a consistent fishery rather than incidental catches of walleye. In most cases, walleye are not stocked in waterbodies where natural reproduction is strong. Recently, introduction of the fish pathogen Viral Hemorrhagic Septicemia (VHSv) to the Great Lakes Basin has significantly altered walleye production and stocking in Michigan and elsewhere throughout the region. Prior to the introduction of VHSv, the MDNRE stocked on average 3 to 5 million spring fingerling walleye each year. In contrast, no walleye were stocked in 2007, only 850,000 fish were stocked in 2008, 1.7 million were stocked in 2009, and stocking will again be limited in 2010. This paper describes actions taken by the MDNRE from 2006 through 2009 to manage walleye production in the State of Michigan around the presence of VHSv in our waters.

## Walleye Culture Process

Unlike some salmonid species we produce, walleye brood sources are not maintained at any state fish hatchery in Michigan. In fact, most MDNRE hatcheries are really designed for rearing trout and salmon rather than coolwater species such as walleye, northern pike, or muskellunge. MDNRE uses three wild Great Lakes sources as walleye brood sources; the Muskegon River; the Tittabawassee River; and Little Bay de Noc. Walleye egg takes occur in the early spring when ripe fish congregate on spawning grounds. The Great Lakes spawning populations used as brood sources are characterized by large fish and larger females have more eggs. Eggs are fertilized, hardened, and disinfected on location, and are then sent to either the Wolf Lake State Fish Hatchery located in Mattawan, or the Thompson State Fish Hatchery located in Manistique. After arriving at the hatchery eggs are incubated for 18 to 28 days before hatching.

Once walleye hatch from the egg they are called fry and are less than 1/2 inch long. Occasionally, fry are immersed in an oxytetracycline (OTC) bath which permanently marks their bones and enables fisheries managers to determine their status as stocked fish later in life. Fry spend 3 to 5 days in the hatchery during which they are sustained by the nutrients in their yolk sac. Before the yolk sac is fully absorbed, fry are shipped to outdoor ponds located throughout the state for rearing to the fingerling stage. Ponds vary in size, shape, and water supply, with some collecting water from natural runoff while others receive water pumped from a local surface or groundwater source. Many of these rearing ponds are owned by private groups that participate in valuable partnerships with the MDNRE to increase the number of walleye available for stocking statewide. Rearing ponds require conditioning prior to and after the arrival of fry. It is crucial that fish predators, capable of severely limiting walleye production, are

removed from these ponds before introducing fry. Ponds are further prepared for the arrival of fry by being fertilized with various organic and inorganic fertilizers to improve plankton abundance and ensure fry have an adequate food source. Technicians continue to fertilize ponds after fry are introduced so that plankton levels remain stable and available as food. As fry approach fingerling size, pond fertilization ceases and plankton levels are allowed to collapse. It is essential to remove fingerlings from the ponds prior to the collapse of plankton populations. If not removed, cannibalism will occur among these young walleye which can significantly limit production. Fry typically reach spring fingerling size between June and July and are ready to be stocked into our waters. The production of spring fingerling walleye is highly variable from year to year and pond to pond.

Fisheries managers make decisions on which waterbodies will be stocked based on production levels and management needs. Recommended stocking rates for spring fingerling walleye are 25 to 100 fish per acre, with appropriate levels determined through experience and success establishing a consistent fishery in a particular lake over time. To the degree possible, biologists attempt to use an "appropriate genetic strain" of walleye when stocking lakes in a given management unit. For example, an inland lake which drains to Lake Michigan in the Lower Peninsula typically receives Muskegon River strain walleye because that river also drains into Lake Michigan. There are instances in history however, when this guidance could not be followed because of less than adequate levels of walleye production and priority management needs.

**Emergence of VHSv in the Great Lakes Basin and Control Measures**

VHSv is a fish virus not native to the Great Lakes that was first isolated by the Ontario Ministry of Natural Resources (OMNR) in 2005 while investigating a significant mortality of freshwater drum that occurred in the Bay of Quinte, Lake Ontario. Although this was the first report of VHSv in the Great Lakes, it was not the earliest identification of the virus. Biologists at Michigan State University had isolated an unknown virus from a muskellunge caught in Lake St. Clair in the spring of 2003, but did not pursue identification of the virus until learning of the OMNR isolation. Confirmation of the Lake St. Clair isolation as VHSv was made in December 2005. These reports of VHSv placed the virus into an emerging pathogen status in the Great Lakes Basin. It is unknown how VHSv was introduced into the Great Lakes Basin. The most likely vector that moved VHSv into our waters is ballast water but other potential vectors are the movement of live fish including baitfish, and the natural migration of fish.

By the spring of 2006, large fish mortalities were observed in Lake St. Clair, the St. Clair River, the Detroit River, the western basin of Lake Erie, Lake Ontario, and the St. Lawrence River. These mortalities are thought to be a single large-scale fish kill event. Fish species affected during the spring 2006 kill event included Great Lakes muskellunge, walleye, lake whitefish, burbot, freshwater drum, yellow perch, gizzard shad, redhorse sucker, and round goby. The disease was subsequently identified in several inland lakes in Michigan, Wisconsin, and Ohio as well.

VHSv is a fish disease reportable to the World Organization for Animal Health (OIE), which necessitates MDNRE reporting of occurrences to the United States Department of Agriculture – Animal and Plant Health Inspection Service (USDA – APHIS). VHSv can be transferred through

the water via urine and reproductive fluids, and can survive in water for at least 14 days. The virus infects gill tissue first, and then progresses to internal organs and blood vessels. Blood vessels are weakened, which results in hemorrhaging of the internal organs, muscle, and skin. Fish can also become infected with the virus by eating other infected fish. Stresses on a fish such as extreme water temperatures, starvation, and spawning can lower immune responses, which could subsequently result in infected fish actually becoming diseased. Fish that survive VHSv infection develop antibodies that will protect the individual against additional infections for some time, but likely not indefinitely. Despite this natural inoculation of fish against further infection, the concentration of antibodies may eventually decrease leaving a fish susceptible to contracting the virus again later. Further study is still needed on this aspect of the disease to be certain of how long a fish may be protected from further infection.

Fisheries managers on the west coast of the United States have three decades of experience managing VHSv in salmon species, and have developed effective disinfection procedures for rearing salmon. Because the virus does not appear to penetrate the egg of salmon species, surface disinfection of eggs is effective in killing the pathogen and protecting hatcheries. However, the MDNRE can not assume that disinfection procedures effective for salmon species will work as well for coolwater species, despite the methods having been recommended by the Great Lakes Fish Health Committee (GLFHC) of the Great Lakes Fishery Commission as appropriate. To date, researchers have not been able to completely confirm the effectiveness of those disinfection procedures for the eggs of coolwater fish species such as walleye, northern pike, and muskellunge. Although progress has been made on evaluating disinfection procedures for walleye and northern pike eggs, there are still gaps in our understanding of VHSv. One key uncertainty remaining is that we don't know if the virus actually penetrates coolwater fish eggs which would likely reduce effectiveness of the surface disinfection method as well. In spite of the current unknowns with coolwater egg disinfection techniques, MDNRE uses the disinfection procedures as one component of a comprehensive biosecurity strategy for managing the risk involved for infecting the waters of the state or our hatcheries with VHSv.

The MDNRE considers VHSv a serious threat to both fish populations and hatcheries in the State of Michigan. Given the public trust responsibilities of the MDNRE, state fisheries management actions must not contribute to transporting or spreading this fish disease. Given the strong likelihood that VHSv will remain present in Michigan waters for the foreseeable future, all fisheries management activities with a potential to spread the disease must include a thorough evaluation of the risks involved when taking those actions.

**Management Timeline**

**2006** – By the time fish mortalities became evident in the spring of 2006, walleye, northern pike, and muskellunge production was already underway. There was no evidence to suggest the virus had spread to the brood source locations for those species, so MDNRE proceeded with normal production and stocking of all coolwater species that year.

MDNRE initiated statewide surveillance in 2006 to identify the occurrence and spread of VHSv in Michigan waters. Samples collected during this surveillance effort were sent to the Aquatic Animal Health Lab at Michigan State University. Samples were tested there for the presence of VHSv using standard cell culture and genetic techniques, with results available approximately

one month after the cultures are started. Samples collected from the northern region of Lake Huron near Alpena and Rogers City in the fall of 2006 tested positive for VHSv; the only other positive location found in 2006 other than the St. Clair River, Lake St. Clair and Lake Erie area. The virus was isolated in samples of Chinook salmon, lake whitefish, and walleye, but no large scale fish kills of these species were observed at the time. Additionally, an archived lake whitefish collected near Cheboygan, MI in the late fall of 2005, obtained from the Chippewa Ottawa Resource Authority (CORA), also tested positive for VHSv. Positive identification of VHSv in Lake Huron, along with previous findings led the MDNRE to designate large portions of the State's waters into three VHSv management areas; a VHSv Free Management Area; a VHSv Positive Management Area; and a VHSv Surveillance Management Area. Each area designation included special regulations for the fisheries operating in those waters. Those designations and rules are available by clicking the Fishing link at the MDNRE internet site (http://www.michigan.gov/dnr).

**2007** – Extensive surveillance for VHSv continued statewide in 2007, largely coinciding with regularly scheduled fisheries surveys of inland lakes, streams, and the Great Lakes. Cell culture remained the method used for identifying presence of the virus. In 2007, MDNRE tested 8,933 samples from 62 inland and Great Lakes locations. Walleye brood sources from the Muskegon River, the Tittabawassee River, and Little Bay de Noc, muskellunge brood sources from Hudson Lake and Thornapple Lake, and our northern pike brood sources from Sanford Lake and Little Bay de Noc were all inspected and all tested negative for VHSv.

In May of 2007 however, VHSv was isolated in fish collected from Budd Lake (Clare County) during investigation of a large fish kill that included black crappie, bluegill, golden shiner, largemouth bass, muskellunge, pumpkinseed, and yellow perch. Budd Lake is a land-locked waterbody with essentially no flow of water in or out, suggesting the source of VHSv in this case was from release or use of infected baitfish or illegally stocked infected gamefish. Samples collected later in the year, after the fish kill, failed to turn up additional positive detections of VHSv. With this occurrence in inland waters, one of the worst case scenarios relative to containing the disease was realized and highlighted the seriousness of the threat to the State's waters and hatcheries. VHSv was showing up in other locations across the basin as well. Samples collected in the spring of 2007 from Lake Winnebago in Wisconsin and from Green Bay on Lake Michigan tested positive for VHSv. Given the apparent spread of the virus across the Great Lakes including some inland waters, and a serious lack of information regarding the transmission of VHSv in coolwater species, the MDNRE did not raise or stock any walleye in 2007 even though our brood sources all tested negative for the disease.

At the time, managers considered using large inland lakes as brood sources for walleye but this option was eventually dismissed because there are generally insufficient numbers of large adult walleye available in any inland lake to meet the egg needs for statewide production. That approach would have been extremely labor intensive and costly to accomplish due to the lack of a concentrated run like we see in the Great Lakes tributary stocks, and large public lakes considered to be best candidates to try as walleye brood sources also have the highest risk of becoming infected with VHSv through bait or some other vector. We also evaluated the use of rearing locations off-site from our hatcheries (e.g. remote field stations or trailers), but those options were dismissed because of problems securing water sources, staff limitations, and their

high cost. There was some small-scale stocking of walleye done in 2007 by CORA and other limited private stockings were approved when fish sources were confirmed VHSv free.

There was no production of northern pike in 2007. The stocking program for northern pike uses fry transferred from the hatchery to rearing marshes. Northern pike eggs hatch in 10 days and are ready to transfer to ponds 7-14 days after hatch. Testing protocols for VHSv require a minimum of 28 days to complete cell culture so there was not enough time between egg take and fry transfer to complete the required testing. Muskellunge production in 2007 was limited to fish transferred to Michigan from Iowa, which tested negative for VHSv. These fish were intensively reared in the Fish Health and Quality lab at Wolf Lake Hatchery. This building isolates coolwater fish from coldwater production and appropriate biosecurity measures were in place to protect the entire hatchery complex from possible VHSv contamination. Lake sturgeon production was done in streamside rearing facilities. Lake sturgeon rearing continued in these facilities because of their isolation from state hatcheries.

**2008** – Surveillance for VHSv, using USDA-APHIS surveillance funding, continued in all Great Lakes States and Provincial waters in the basin. Few samples collected during these efforts tested positive for VHSv. Cell culture remained the standard used to accurately identify VHSv, using Polymerase Chain Reaction (PCR) as a confirmatory test. The occurrences of VHSv expanded further in 2008 to include a new inland detection in Clear Fork Reservoir, Ohio, the first water outside of the Great Lakes Basin, and new Great Lakes detections in Illinois and Wisconsin waters of Lake Michigan. In 2008, MDNRE tested 7,156 samples collected from 57 Great Lakes and inland locations. None of the fish tested by MDNRE were positive for VHSv. MDNRE also tested 650 samples from our walleye brood sources over multiple occasions in 2008 and all were negative for VHSv. Muskellunge and northern pike brood sources were again tested in 2008 and all were negative for VHSv. Samples collected from Budd Lake in 2008 were also negative. In response to the continued negative results of our surveillance testing on brood sources for walleye, we began a limited rearing program in 2008. Stringent restrictions were placed on brood sources, disinfection procedures, disease testing regimes, and biosecurity measures. In addition, MDNRE aimed to further minimize risk of spreading the disease to inland waters and state hatcheries by carefully selecting rearing ponds and stocking locations around the state.

*Walleye Brood Sources* – Given that VHSv had caused fish kills in the Lake St. Clair-Lake Erie basin and the Lake Huron Basin, the Tittabawassee River brood source was considered the highest risk for VHSv transfer. The Little Bay de Noc source population represented the second highest risk for transferring the disease because VHSv was found in southern Green Bay. The Muskegon River brood source was believed to have the lowest risk for transferring VHSv because it was furthest away from previous detections of the virus at that time. Consequently, a decision was made to use only the Muskegon River population as a brood source for walleye production in 2008.

*Disinfection Procedures* – Despite documented success disinfecting eggs of salmon species, researchers were unable to confirm the effectiveness of egg disinfection procedures in killing VHSv on coolwater species eggs in 2008. Egg-infectivity trials at Cornell University were inconclusive, in spite of premature media reports to the contrary. MDNRE experiments to determine the effectiveness of iodine disinfection were unsuccessful because we were unable to

collect eggs from infected wild fish. We were also unable to artificially infect eggs with VHSv in 2008 and so did not pursue in vitro experiments. Notwithstanding the uncertainty regarding effectiveness of the disinfection protocols for coolwater fish eggs, the GLFHC still recommended an iodophor disinfection protocol prior to bringing coolwater eggs into hatcheries.

*Biosecurity Measures* – The GLFHC made several recommendations to protect hatcheries from becoming contaminated with VHSv, including: testing source waters used for egg takes, implementing disinfection methods, annual testing and fish health inspections for brood sources and production lots, hatchery fish health certifications, and considerations for developing protected Great Lakes salmonid and non-salmonid brood source lines. Other general guidance included the requirement that eggs being moved between hatcheries were disinfected prior to transfer, and that hatchery equipment and trucks were disinfected after each use. MDNRE has incorporated many, if not all, of these measures towards protecting state hatcheries from contamination with VHSv. The most ominous recommendation from the GLFHC was that agencies should destroy all fish at hatcheries found to be contaminated with VHSv; a recommendation that is consistent with the OIE Aquatic Animal Health Code. Inclusion of such a recommendation by these multi-agency and international animal health organizations highlights the seriousness of contaminating a hatchery with VHSv.

The cost of depopulating and disinfecting an entire hatchery in Michigan would be astronomical in many ways, and the idea that such a thing might happen with VHSv has been taken very seriously by the MDNRE. In the mid-1980s, the MDNRE was faced with such a catastrophe. The Marquette State Fish Hatchery was depopulated and disinfected when Epizootic Epitheliotropic Disease Virus (EEDv) was identified as the cause of mortalities in lake trout. The cost to the MDNRE was significant and the loss of fish was a major setback to lake trout restoration efforts. Taking appropriate biosecurity measures to avoid a similar catastrophe with VHSv is critical.

To minimize the risk of contaminating hatcheries, walleye egg incubation in 2008 was limited to the Thompson State Fish Hatchery since incubation there could be isolated from other rearing areas by constructing a wall and reconfiguring the plumbing. Unfortunately, the Thompson Hatchery was designed as a coldwater fish hatchery and steelhead rearing is a primary purpose. Coolwater production capabilities, including our attempts to isolate the walleye incubation area, were retrofits aimed at making the best of a facility that was designed for other purposes. Efforts at the Thompson Hatchery reduced the risk of spreading VHSv to other species being reared there, but it did not ensure 100% elimination of the risk. As an additional precaution, all steelhead eggs normally incubated at the Thompson Hatchery were instead incubated at Wolf Lake Hatchery. Additionally, steelhead eggs were not transferred back to the Thompson Hatchery until walleye fry had been transferred to rearing ponds and disinfection of the incubation area had been completed.

*Disease Testing Regime* – All three Michigan walleye brood sources were tested in February 2008 prior to spawning and again at the time of spawning. In addition to the standard 60 fish used for full health inspection, all adults used for spawning were sacrificed with tissue samples collected specifically for VHSv testing. Fish sacrificed were filleted by Fisheries Division staff and donated to local shelters (VHSv is not a human pathogen and presents no consumption risk for people). If any adult walleye had tested positive for VHSv, all eggs and/or fry produced from

those eggs would have been destroyed statewide; however, none of the fish tested positive for VHSv. Later in the production process, VHSv testing continued with 1,500 fry from each day's egg take. None of these fish tested positive for VHSv. Although all adults used for egg collection were VHSv-negative, fry could also be exposed to the virus via the open water sources of rearing ponds. Thus, fingerlings from all rearing ponds were also tested prior to any fish being stocked. As with adults, if any fingerlings had tested positive for VHSv all fish from that pond would have been destroyed.

*Selection of Rearing Ponds and Stocking Locations* – The final precaution against spreading VHSv to previously uninfected waters was to be highly selective in our use of rearing ponds and stocking locations. Rearing ponds were limited to non-drainable ponds without connections to other surface waters. Walleye stocking was limited to spring fingerlings which were only stocked into inland lakes without inlets or outlets, or into inland lakes with immediate connections to a Great Lake already designated as a VHSv-Positive or Surveillance Management Area. As such, absolutely no walleye rearing or stocking took place in the Lake Superior Basin which was still designated a VHSv-Free Management Area. Walleye fry are ready for transfer to rearing ponds or for direct stocking into State waters at 1-5 days old. It takes 28 days to complete testing for VHSv, therefore, no direct stocking could be done, only transfers to rearing ponds where fish would be held for an additional 40-60 days prior to stocking. This conservative approach to rearing and stocking walleye in inland waters was far safer than implementing full production, but it also greatly reduced the number of active rearing pond partnerships and acceptable stocking sites statewide.

*Other Coolwater Fish Species* – There was no production of northern pike in 2008 for the same reasons provided in the summary for 2007. Culture and stocking of muskellunge from Michigan broodstocks began again in 2008. Eggs were taken from Thornapple Lake and Lake Hudson where we have historical fish health inspection data showing the stocks are VHSv negative. Non-lethal samples were collected from all fish spawned and handled including blood, milt, and ovarian fluid for VHSv testing. Eggs were incubated and fry were intensively reared in the Fish Health and Quality lab at Wolf Lake Hatchery. This building isolates coolwater fish from coldwater production and appropriate biosecurity measures are in place to protect the entire hatchery complex from possible VHSv contamination. Muskellunge fry were tested for VHSv, and since all were negative, spring fingerlings were available for stocking into approved waters. Muskellunge fall fingerlings received a full health inspection, including testing for VHSv, prior to being stocked in the fall and were negative as well. As in 2007, Lake sturgeon production was limited to streamside rearing facilities.

**2009** – Surveillance for VHSv, using USDA-APHIS surveillance funding, continued in all Great Lakes States and Provincial waters in the basin, although at a lower level because of budget constraints. Cell culture remained the standard used to accurately identify VHSv, using Polymerase Chain Reaction (PCR) as a confirmatory test. The occurrences of VHSv expanded further in 2009 to include a new inland detection in Baseline Lake, Washtenaw County (Huron River watershed). Brown bullheads collected during surveillance sampling were positive for VHSv. Although VHSv has already been found in Lake St. Clair, two additional VHSv positive findings were reported for Lake St. Clair in 2009. The first positive was in ovarian fluid collected from Great Lakes strain muskellunge during an annual health inspection and the second was in

smallmouth bass during a fish kill. While VHSv was found in the smallmouth bass, additional pathogens were identified and the primary cause of the kill could not be determined. In 2009, MDNRE tested 7,261 samples collected from 64 Great Lakes and inland locations. Coolwater brood sources were again tested in 2009 and all were negative for VHSv. These included walleye from the Muskegon River, the Tittabawassee River, and Little Bay de Noc, muskellunge from Hudson and Thornapple lakes, and northern pike from Sanford Lake and Little Bay de Noc.

*Walleye Brood Sources* – Walleye production expanded slightly in 2009 to make use of both Muskegon River and Little Bay de Noc brood sources. Because VHSv was found in southern Green Bay and southwest Lake Michigan, we believed the addition of the Little Bay de Noc strain presented no more risk of transferring VHSv into our hatcheries than the Muskegon River strain did. Our decision was also made in light of the fact that CORA had used this same brood source in 2008 with extensive testing and no positive results for VHSv. Because of differences in the timing of walleye spawning runs in the Muskegon River and Little Bay de Noc, using both brood sources allowed crews to run egg-take operations over a longer period. Despite no detections of VHSv in Tittabawassee River walleye, it was again our opinion that the close proximity of this brood source to places where the virus caused large fish kills posed a higher risk. Also, timing for the Tittabawasee River run occurs the same time as the Muskegon River run so taking eggs at the Tittabawasee would not provide the timing advantage the Little Bay run does to allow for additional fry production at the hatchery. Although using Tittabawassee River walleyes would have provided the preferred genetic strain for stocking into the Lake Huron watershed, research has determined little genetic difference between Muskegon River and Tittabawassee River walleye. This is not surprising given the main source used to rehabilitate the Tittabawassee River population was the Muskegon River, and insufficient time has transpired to allow for significant genetic divergence. Consequently, by not using the Tittabawassee River as a brood source we did not further restrict walleye stocking in the Lake Huron basin in 2009.

*Disinfection Procedures* – In 2009, the MDNRE continued to use the GLFHC-recommended disinfection protocol for coolwater eggs (see above). Additionally, researchers remained unable to confirm the complete effectiveness of egg disinfection procedures in killing VHSv on coolwater fish eggs.

*Biosecurity Measures* – In 2009 we utilized the same biosecurity measures as we did in 2008. Walleye egg incubation was limited to the Thompson Hatchery and steelhead eggs were not transferred to the Thompson Hatchery until walleye fry had been transferred to rearing ponds and disinfection of the incubation area had been completed. Because production at the Thompson Hatchery is limited to 6 million fry, we looked into additional incubation facilities outside of the state hatchery system. The Mason County Walleye Association was assessed for its potential to incubate and hatch walleye eggs. It was determined that water from their well would require processing to improve its quality before it could be used for fish rearing. Additionally, some work would need to be done where water would be discharged from the building because of concerns by the club with water pooling near the building. While the club was willing to invest in the changes to their facility for this project, with no guarantee that the State would use it in the future, they opted to wait until it was clear that the State would use their facility. Although we did not have any agreement with CORA regarding walleye stocking in 2009, they ended up offering and stocking surplus walleyes in several prescribed Upper Peninsula inland lakes

*Disease Testing Regime* – The testing regime for VHSv as it related to walleye culture in 2009 was identical to that used in 2008 (see above). There were no positive results for VHSv in any samples collected.

*Selection of Rearing Ponds and Stocking Locations* – In 2009, the MDNRE implemented the same rearing pond and stocking location criteria used in 2008 (see above).

*Other Coolwater Fish Species* – There was no production of northern pike in 2009 (for reasons provided in 2007), though muskellunge production continued in the same manner as in 2008. As in previous years, Lake sturgeon production was limited to streamside rearing facilities.

**2010** – Several key questions about VHSv remain unanswered that will again limit our coolwater fish production in 2010. Chief among those unknowns is the effectiveness of disinfection techniques in killing VHSv on coolwater fish eggs, and our need to find faster, more reliable ways to detect the virus in fish samples. Although the United States Geological Survey (USGS) and United States Fish and Wildlife Service (USFWS) found that a disinfection procedure eliminated the active VHS virus on the outside of fertilized walleye and northern pike eggs, the research did not resolve the question of whether disinfection will work if virus enters an egg at the time of fertilization. Progress was made on developing a rapid test for VHSv in 2009, though it was not available at the time of writing this report. As in 2009, ongoing research at Cornell University and the New York State Department of Environmental Conservation will focus on understanding the essential aspects for managing VHSv. Other gaps in our understanding about VHSv that have huge management implications include: knowing how long the virus can survive outside of a fish host; finding reliable ways to detect VHSv in the water prior to fish kill events; understanding how the immune response in fish may provide protection against future infections; and quantifying the full range of susceptibility for various Great Lakes fish species to the disease. Without major progress in these areas it is hard to imagine how MDNRE will effectively manage the risk of spreading VHSv to our hatcheries and inland waters or significantly expand our coolwater fish production back to former levels. Surveillance for VHSv will continue in all Great Lakes States and Provincial waters in 2010, with additional effort in locations where VHSv was a new detection. These include Baseline Lake, Washtenaw County and downstream in the Huron River watershed and in Lake Superior where some samples collected by Cornell in late 2009 were positive with PCR (confirmation of findings is still pending)

*Walleye Brood Sources* – Walleye brood sources in 2010 will again include the Muskegon River and Little Bay de Noc. Although routine testing of Tittabawassee River walleyes has not identified the presence of VHSv, the potential link of that source with fish kills believed to have resulted from exposure to the disease increases our perceived risk for utilizing it as a current brood source in 2010. Also, as in previous years, because of the timing of this run, using this stock would not provide additional fish for stocking.

*Disinfection Procedures* – The MDNRE continued to use the GLFHC-recommended disinfection protocol for coolwater eggs.

*Biosecurity Measures* – We will utilize the same biosecurity measures in 2010 as we did in 2009. Walleye egg incubation will be limited to the Thompson Hatchery and steelhead eggs will not be transferred to the Thompson Hatchery until walleye fry had been transferred to rearing ponds and disinfection of the incubation area had been completed. The Mason County facility will not be used in 2010 because there is no present need for additional space for incubating and hatching fry. Thompson is able to produce 6 million walleye fry when egg takes can be at least one week apart. The number of rearing ponds that can be used under our current rearing strategy utilize approximately 5.2 million fry. Until there are changes to the waters that can be stocked and the rearing ponds that can be used, additional incubation space is not needed. We will continue to work with CORA, as in past years.

*Disease Testing Regime* – The testing regime for VHSv as it related to walleye culture in 2010 will be identical to that used in 2009. If new tools become available in a timely fashion for incorporating into the 2010 walleye culture and stocking program we will implement those as appropriate.

*Selection of Rearing Ponds and Stocking Locations* – In 2010, the MDNRE will implement the same rearing pond criteria as used in 2009, and the stocking location criteria will be almost identical to 2009. The only difference for stocking locations is the potential addition of a few (<5) waterbodies that did not meet the previously established criteria. Biologists are in the process of proposing waterbodies, and evaluating the risk associated with each. This is reflective of an effort to slowly start expanding our stocking efforts into waters that may present an additional level of risk given our knowledge and ability to treat for this disease. To address concerns over the implications of mixing walleye strains, the strain of walleye available for stocking will be of primary consideration for managers when analyzing a location for walleye stocking. The potential of the proposed stocking event to result in significant mixing of strains must be evaluated. Use of Muskegon River and Bay de Noc strain walleyes in Lake Huron or connected waters will be closely scrutinized, with appropriate justification provided by managers to the Basin Coordinators. Although there are only slight genetic differences between Muskegon River, Bay de Noc, and Tittabawassee River walleyes, and Muskegon River walleyes were actually used in the rehabilitation of Saginaw Bay, it is justifiable to hold ourselves to the highest standard in order to avoid the potential loss of genetic diversity. There is little or no concern regarding use of Muskegon River or Bay de Noc strain walleye to stock inland waters in the Lake Huron or Lake Erie Basins that meet the very stringent criteria for no inlet or outlet as there is no probability of those fish moving into the Great Lakes from those sites.

*Other Coolwater Fish Species* – As in 2009, there will be no production of northern pike in 2010, though muskellunge rearing will continue as it has in the previous two years but at 50% of normal production, 20,000 fall fingerlings, due to reduced staffing at Wolf Lake. As in previous years, Lake sturgeon production will be limited to streamside rearing facilities.

*Coolwater Fish Production in 2011 and Beyond* – It's a fine line between responsible natural resources policy and accomplishing all that stakeholders want when faced with a problem as widespread and potentially harmful as VHSv. This is especially true when the threat to our fish populations, lakes and streams, or hatcheries seems to have passed and the detrimental impacts are no longer obvious. Still, it is our job to protect, conserve, and manage the fisheries resources

of Michigan for the use and enjoyment of current and future generations. We know that protecting first is always less expensive and preferable to restoring lost fisheries later, particularly when the future funding and capacity for such work is so uncertain.

We recognize that walleye fisheries and rearing pond partnerships may have suffered over the past few years as we have dealt with the presence of VHSv. To be sure, we value those fisheries and partnerships very much and look forward to reinvigorating those relationships soon. When we do, it will be with the same energy and commitment as ever, but also with the confidence of knowing that we are doing all that is possible to manage this threat to the fisheries resources of Michigan. We appreciate the continued patience and understanding of our stakeholders directly impacted by the limited coolwater production in recent years and thank you for your support.